



Crack monitoring survey during rough water trials period #2

02/08/2011 – 02/14/2011

Conducted by:

Scott Ritchey

Nancy Adler

The Performance and Evaluation Branch (Code 6S3) of the
Structures and Composite Division (Code 65), Naval Surface Warfare Center – Carderock

Matthew Pischel

In Service Structural Engineering Office (Code 6S02) of the
Structures and Composite Division (Code 6S), Naval Surface Warfare Center – Carderock

Prior to the second set of rough water trials onboard USS Freedom (LCS-1) several cracks were found. These cracks were above the main deck. Prior to getting underway a repair or mitigation procedure was used for most of the cracks. The cracks that were not repaired/mitigated were found to late for that process to take place or while underway. In Table 1 all known cracks along with their locations are listed, current as of the date of this report.

Crack #:	Level:	Frame:	Side:	Description:	Repaired?	Mitigated?	Status:	Length:	Noticed:
1	02	23	Starboard	Radar foundation gusset	Yes	No	Stable	NA	Pre-Trials
2	01	25	Starboard	Top forward corner of intake 5-18-01-E	No	No	Cracked	6.375"	02/13/2011
3	03	29	Centerline	Deckhouse point	Yes	No	Stable	NA	Pre-Trials
4	03	37	Port	Deck edge	Yes	No	Stable	NA	Pre-Trials
5	03	37	Starboard	Deck edge	Yes	No	Stable	NA	Pre-Trials
6	03	41	Port	Deck edge	Yes	No	Cracked	10.75"	Pre-Trials
7	03	41	Port	In 03 level decking close to the repaired crack	No	No	Cracked	1.75"	02/10/2011
8	03	41	Starboard	Deck edge	Yes	No	Questionable	NA	Pre-Trials
9	03	41	Centerline	At forward port corner of walk way connecting fr 41 to 45	No	No	Cracked	1.125"	02/13/2011
10	03	41	Centerline	At forward stbd corner of walk way connecting fr 41 to 45	No	No	Cracked	2.25"	02/13/2011
11	02	41.5	Starboard	At the deck edge along weld connecting side shell facade covering rocket launch area to 02 deck plate	No	No	Cracked	11.125"	02/11/2011
12	02	41.5	Starboard	At the deck edge starting in corner of deck drain hole	No	No	Cracked	0.375"	02/11/2011
13	2nd Plat	48	Starboard	Along weld under stiffener/chine traveling through frame cutout	No	No	Cracked	4.625"	02/13/2011
14	Main	57	Port	Aft Port corner of deckhouse below bi-metallic strip	No	Yes	Cracked	2"	Pre-Trials
15	Main	57	Port	Side shell traveling forward above bi-metallic strip	No	Yes	Cracked	8.5"	Pre-Trials
16	Main	57	Port	Aft port fashion plate above bi-metallic strip	No	Yes	Cracked	8.5"	Pre-Trials
17	Main	57	Port	Aft corner of Deckhouse above bi-metallic strip	No	Yes	Cracked	18.625"	Pre-Trials

Table 1: Listing of all known cracks with their location and status

Prior to getting underway the Structures and Composite Division (Code 6S) from the Naval Surface Warfare Center – Carderock Division (NSWCCD) was informed of the cracks. Code 6S was already sending engineers to LCS-1 to ride for rough water trials. The trials were being conducted by the Seakeeping Division (Code 5500), also from NSWCCD, in conjunction with Code 6S. It was asked of Code 6S while underway to monitor the cracks and send daily reports. Inspections were conducted each day from 02/08/2011 through the date of this reports distribution. All inspections, except for one, were conducted on the exterior of the ship. On 02/09/2011 the seas were too rough to conduct an inspection of the exterior.

The sea conditions while we were out were as follows:

- 02/08/2011 – 6'
- 02/09/2011 – 9' to 10' decreasing to 6'
- 02/10/2011 – 6' decreasing to 4'
- 02/11/2011 – In port Eureka, CA for fuel
- 02/12/2011 – 4' increasing to 8'
- 02/13/2011 – 8' decreasing through the day
- 02/14/2011 – Built through the night to 12'

Due to the crack below the water line rough water trials has been suspended. These cracks will be monitored by code 65 until the ship arrives in port at San Diego, CA. Any changes to the cracks will be reported to CO Edwards and John Fulton as has been done previously.

The crack numbers from Table 1 will be used as a reference in the detail section that follows.

1. This crack was repaired prior to rough water trials. It has been inspected and has not re-cracked. The original crack was along the weld that connects the forward inboard gusset of the radar foundation to the 02 level deck plating.

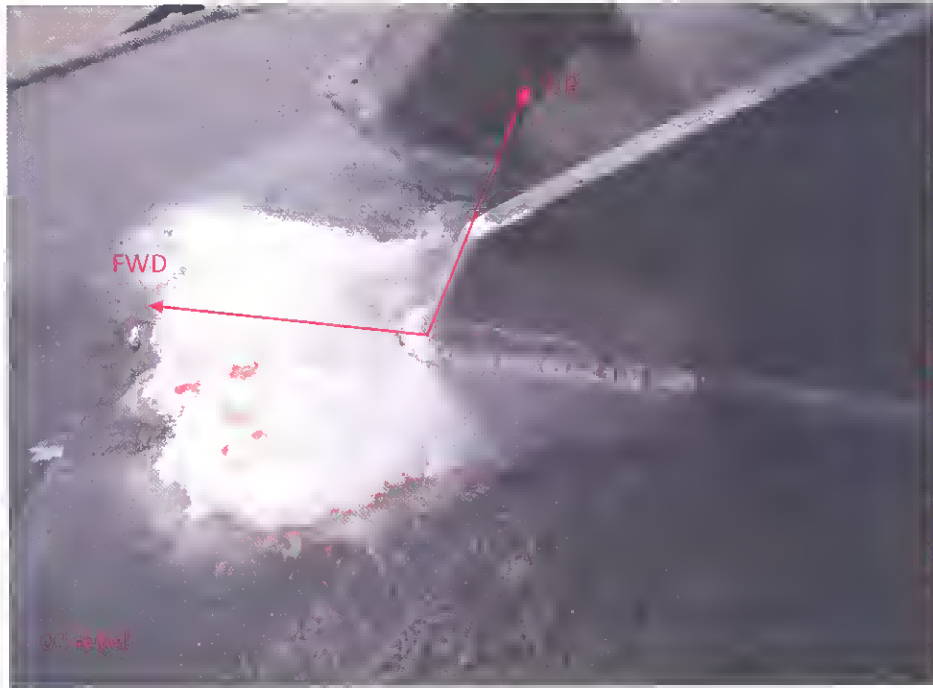


Figure 1: Frame 23, 02 Level, Radar foundation gusset

2. This crack is in the top forward corner of the intake. The crack extends from the shell plating and into the collar forming the rim of the intake. Of the 6.375" total length only 3.375" is in the shell plating while the rest is in the collar itself.



Figure 2: Frame 25, 01 Level, Intake 5-18-01-E top forward corner

3. This crack is really multiple cracks all extending from a common starting point. The cracks are in the 03 level deck plating. All had been welded over as a repair prior to getting underway. None have started to re-crack

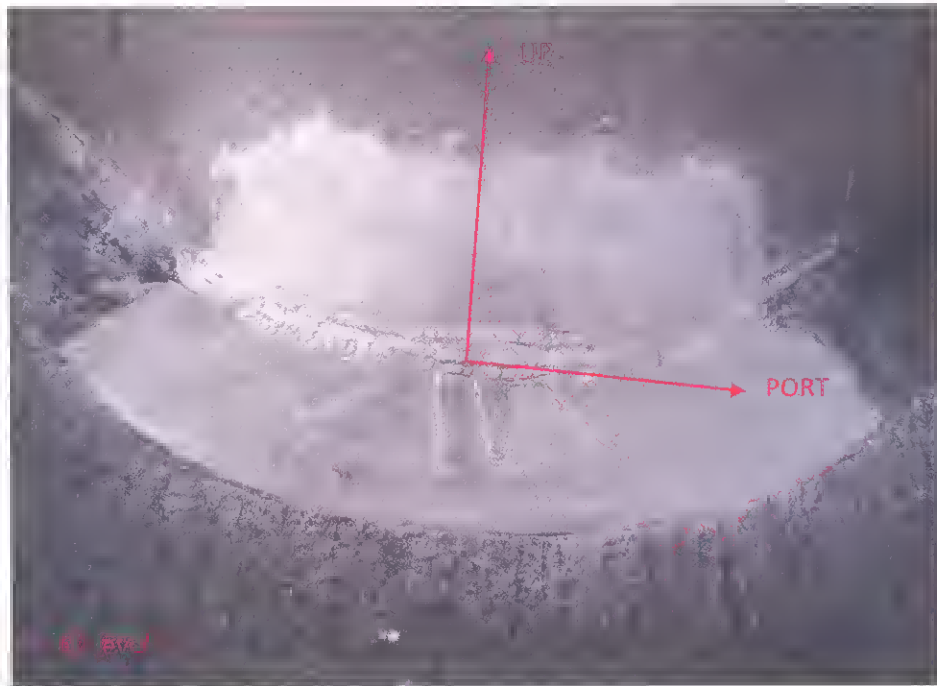


Figure 3: Frame 29, 02 Level, Deckhouse peak

4. This crack is located where the 03 level has an elevation change. It had been welded over as a repair prior to getting underway and has not re-cracked.

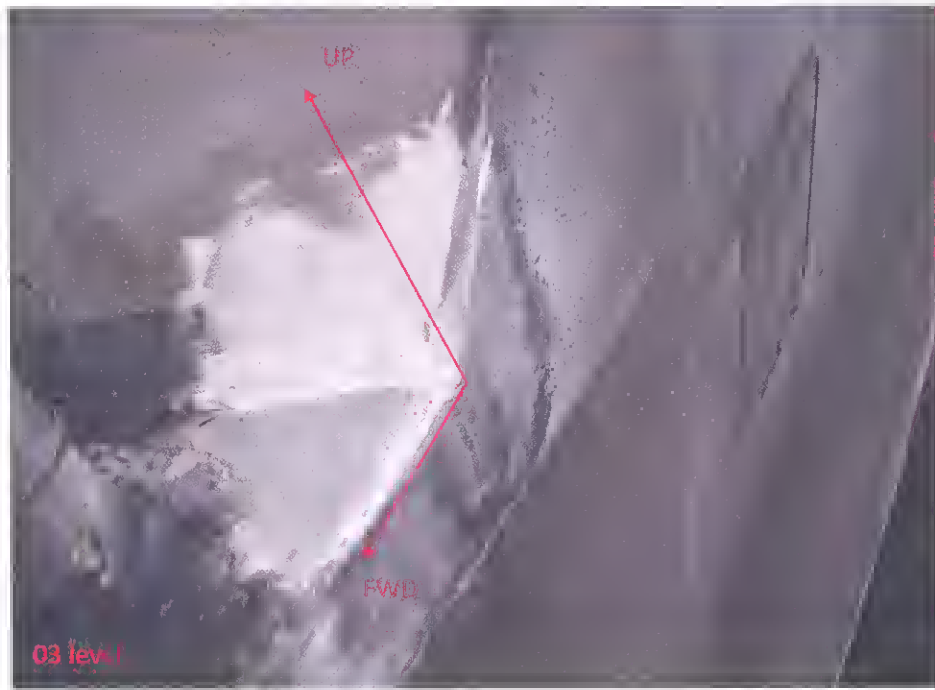


Figure 4: Frame 37, 03 Level, Deck edge, Port

5. This crack is the same a crack #4 but on the starboard side. Also in this same area there is a crack at the top of an intake just below the elevation change mentioned earlier. It too had been welded over as a repair prior to getting underway and has not re-cracked.

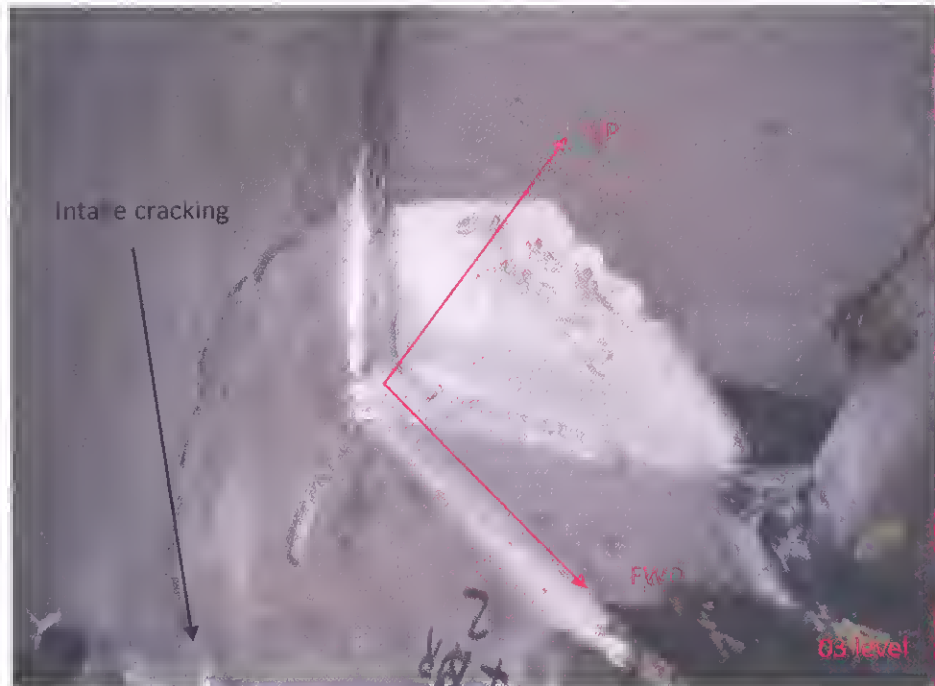


Figure 5: Frame 37, 03 Level, Deck edge, Starboard

6. The re-cracking at this location was first discovered on 02/10/2011. When discovered the crack ran a total of 8.875". This weld is where the top of the shell facade that covers the rocket launch area and life boats mates to the aft exterior face of CE5R #2. The crack ran 1.375" on the outboard side rounded the corner and covered the entire 5.5" upper width of the facade and then turned the corner and ran 2" down the interior of the shell. The upper portion of the facade is an upside down "U" channel. The crack runs along all three surfaces of the "U". On 02/11/2011 a 0.25" crack growth was found on the outboard portion on the crack. No crack growth was discovered until 02/13/2011. That time a growth of 0.875" was discovered on the outboard side again as well as a growth of 0.125" on the inboard side. On 02/14/2011 crack growth was again found in the outboard crack. The outboard crack now measures 3.125" and travels the complete length of the repair weld shown in Figure 9. These last two crack growths contributed to the overall length of 10.75".

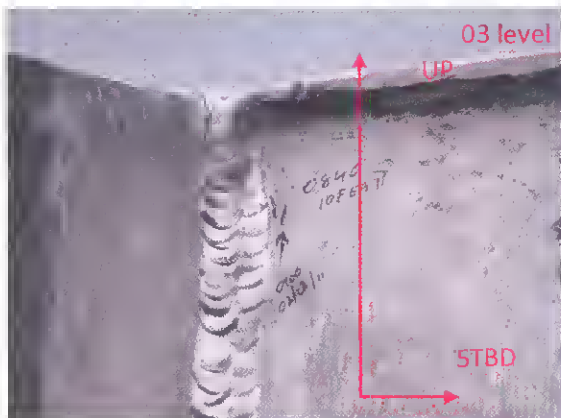
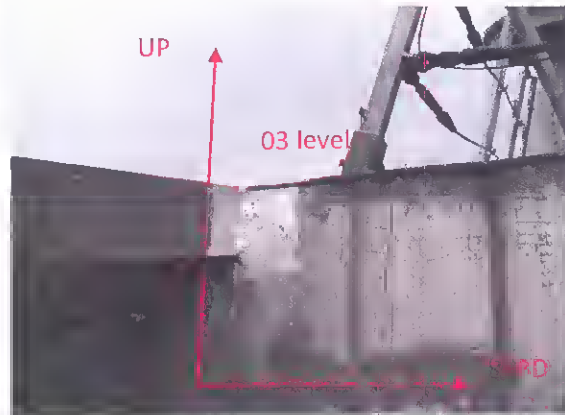
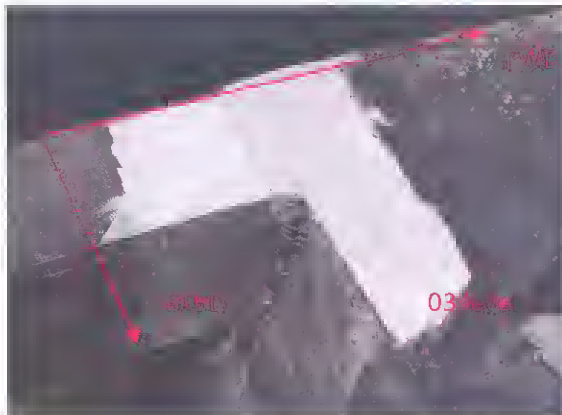


Figure 6: Top left, Frame 41, 03 Level, Deck edge, Port, Crack through depth

Figure 7: Top Right, Frame 41, 03 Level, Deck edge, Port, Inboard

Figure 8: Bottom Left, Frame 41, 03 Level, Deck edge, Port, Inboard crack

Figure 9: Bottom Right, Frame 41, 03 Level, Deck edge, Port, Outboard crack

7. The location of this crack is very close to crack #6. It is actually in the deck plating of the 03 level just forward of crack #6. It is in a slight crescent shape and was discovered on 02/10/2011 and has not grown since then. This crack measured 1.75" from tip to tip but is actually slightly longer due to the shape of the crack.



Figure 10: Frame 41, 03 Level, Deck edge, Port, Crack #8

8. This location is on the starboard side and has the same geometry as crack #6. Upon inspection of the exterior side s of the “U” no re-cracking was found. However there could be a crack on the inside of the “U”. This area is hard to see and therefore hard to determine if it is a crack or something else.



Figure 11: Frame 41, 03 Level, Deck edge, Starboard

9. The inspectors were not made aware of this crack until 02/13/2011 When found it measured 1.125" long. It extends from corner of a walkway on the 03 level.

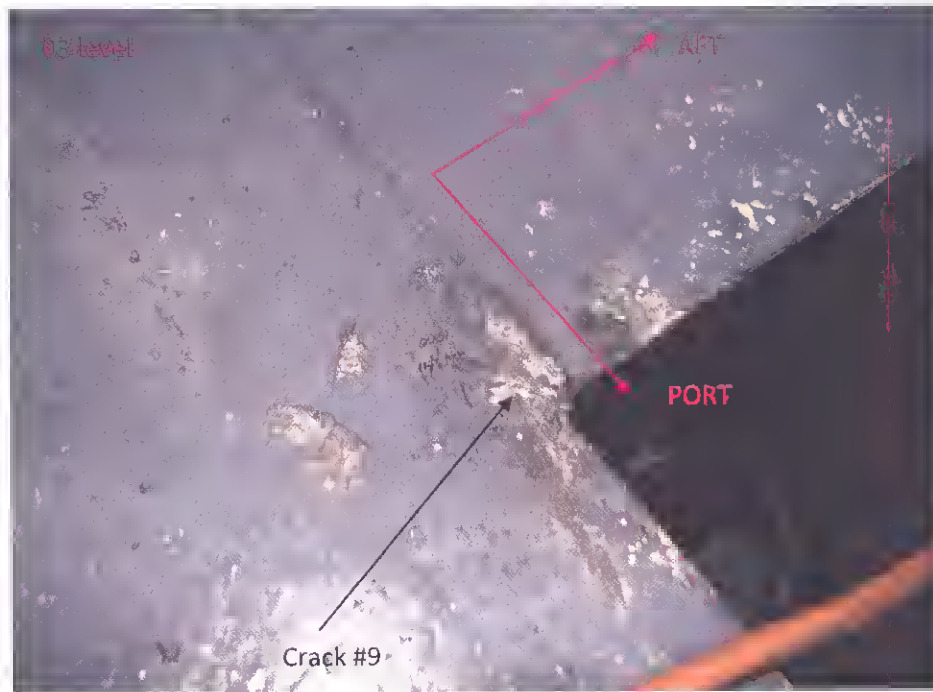


Figure 12: Frame 41, 03 Level, Port side of center walkway

10. This crack matches crack #9 only on the starboard side. It measured 2.25" upon discovery on 02/13/2011.



Figure 13: Frame 41, 03 Level, Starboard side of center walkway

11. This crack is in the weld that mates the starboard side shell facade covering the rocket launch area to the 02 level deck plating. It was shown to us by the crew on 02/11/2011 and has not grown past the 11.125" it was when discovered.



Figure 14: Frame 41.5, 02 Level, Starboard, Outboard view of shell plating

12. This crack was discovered the same day as crack #11. It was found when inspecting crack #11 as is in the corner of a drain hole off the 02 level.



Figure 15: Frame 41.5, 02 Level, Starboard, Outboard view of shell plating, Deck drain

13. This crack was discovered by a crew member. It is below the waterline and is currently allowing water in. It is located where the chine meets the lower portion of hull. It travels through a cut out in frame 48 and totals 4" in length. When discovered there was rust washing onto the painted surface. It is thought this is rust from the exposed crack surface. It is unknown how long this crack existed prior to being discovered.

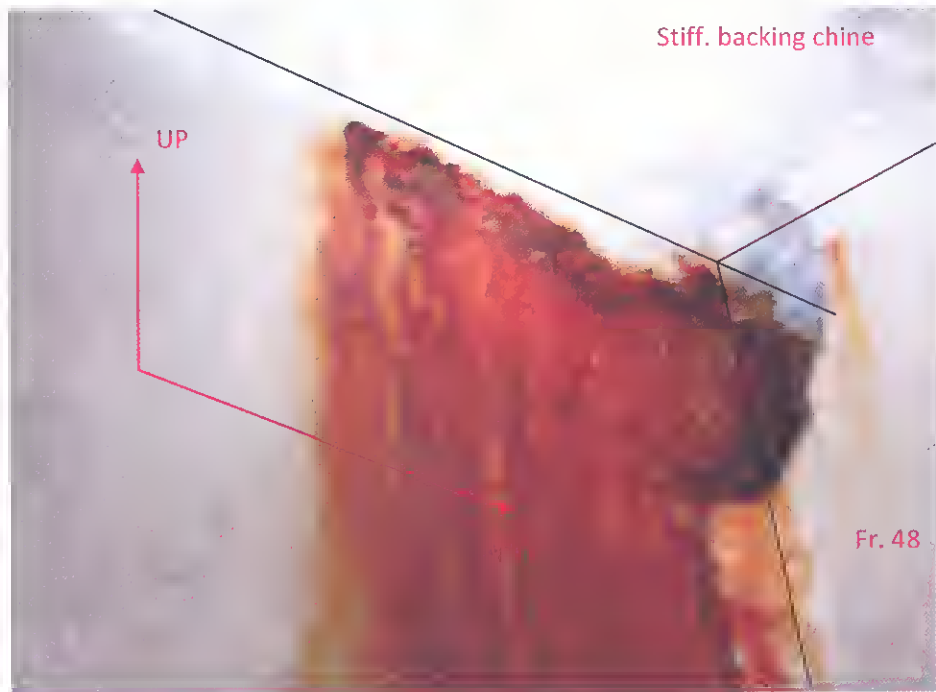


Figure 16: Frame 48, 2nd Platform, Starboard, View looking at frame 48 and chine stiffener

14. Crack located in steel below the bi-metallic strip. It is a vertical crack extending away from the bi-metallic strip. The crack can only be seen from the outside and with a mirror while leaning over the fashion plate. The location has been inspected each day from the inside to watch for growth through the thickness of the metal. No growth has been found.

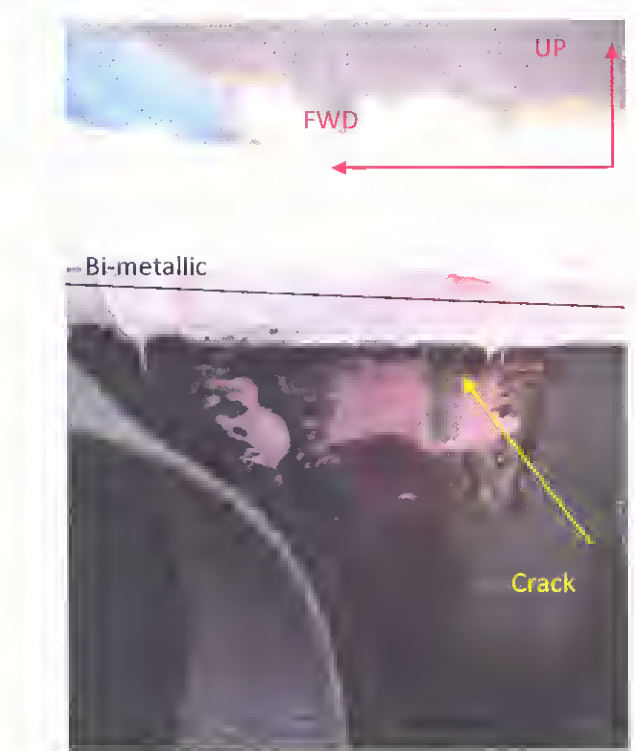


Figure 17: Frame 57, Main Deck, Port, Outboard view of shell plating

15. Crack #15 travels from the aft port corner of the deck house forward along the upper weld of the bi-metallic strip. This crack was thought to have been mitigated with a 0.625" hole drilled through the crack tip. From the mitigation hole a growth of 1.25" was found over the course of the inspections contributed to the overall length from corner to tip of 8.5".



Figure 18: Frame 57, Main Deck, Port, Interior view of port aft deckhouse corner

16. This crack starts in the same corner as crack #15. Like with crack #15 a 0.625" hole was drill in an attempt to mitigate the crack. Crack #16 travels aft along the upper weld of the bi-metallic strip through the fashion plate. The growth of 0.375" from the mitigation hole contributes to the overall length of 8.5".

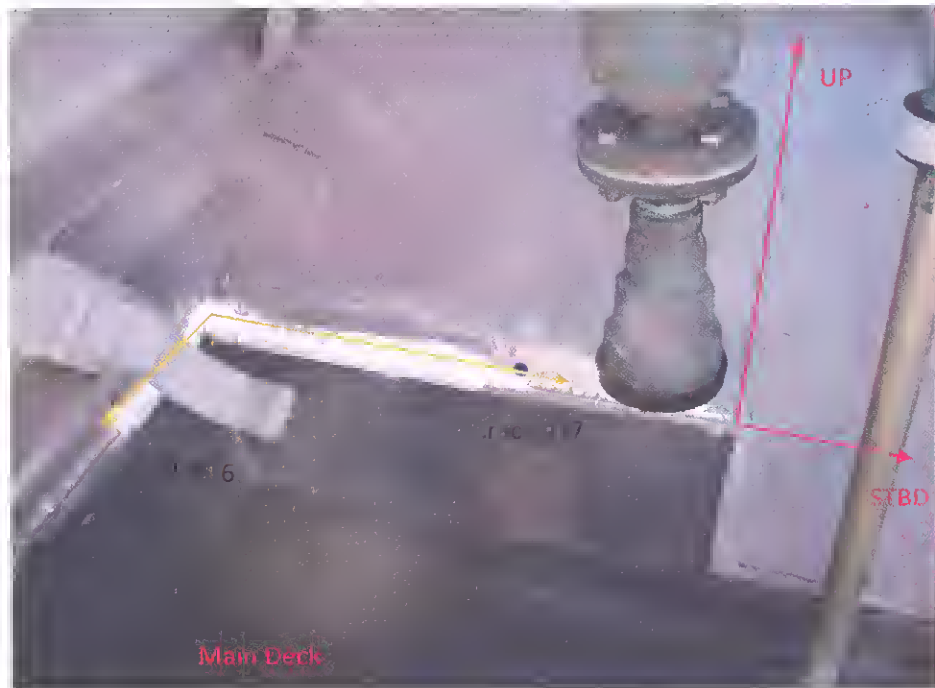


Figure 19: Frame 57, Main Deck, Port, Exterior view of port aft deckhouse corner

17. Again this crack starts in the same corner as crack #15. Again a 0.625" hole was used in an attempt to mitigate the crack. The crack travels along the upper weld of the bi-metallic strip along the aft face of the deck house starting from the mitigation hole. Growth of 2.75" from the hole adds to the total length of 18.625".



Figure 20: Frame 57, Main Deck, Port, Interior view of port aft deckhouse corner